CHITTENDEN COUNTY RPC
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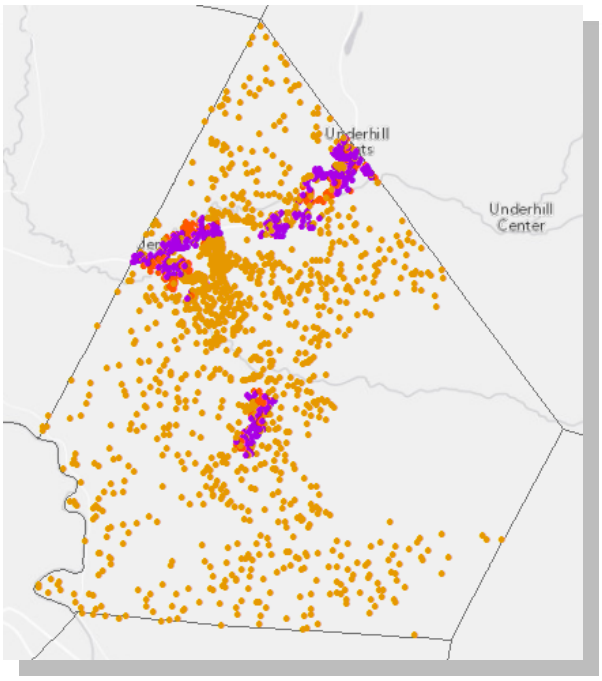


Town of Jericho Build Out and Common Impacts Analysis

Funded by Vermont Municipal Planning Grant FY2011

May 2012

Introduction
The Chittenden County Regional Planning Commission (CCRPC) conducted a project for the Town of Jericho to assist them with understanding how additional residential and commercial development will impact energy use, population, water use, auto emissions, and traffic. With input from the Town Planning Commission, CCRPC utilized a GIS based analysis tool, CommunityViz, to develop six scenarios to answer questions on how zoning may be implemented or changed in the future and what effect those changes will have on the community. The analysis is divided into two parts 1) Build out Analysis and 2) Common Impacts Analysis.

Build Out Analysis
The build out analysis provides the Town with an understanding of the location and amount of potential development, given density standards, existing development, and environmental constraints. The build out assumptions were developed in consultation with the Director of Planning and Zoning and based upon the Town's land use and development regulations effective March 11, 2010. The build out analysis models the number of additional dwelling units and commercial floor area (in square feet) at full build out. Six scenarios were developed that represent a slightly different future for the Town. These six scenarios are 1) base scenario 1A, 2) base scenario 1B, 3) alternative scenario 1A, 4) alternative scenario 1B, 5) alternative scenario 2A, and 6) alternative scenario 2B.

Base scenario 1A and **base scenario 1B** reflect **current zoning standards** and the **current zoning district map** (See Map 1). Base scenario 1A models development potential under standard subdivision regulations while base scenario 1B models development potential based on PUD standards. Both scenarios utilize the current zoning map.

Alternative scenario 1A and **alternative scenario 1B** reflect **current subdivision zoning standards** and **an alternative zoning district map** (See Map 2) that expands the Commercial and Village districts. Alternative scenario 1A models development potential under standard subdivision regulations applied to the alternative zoning map. While alternative scenario 1B models development potential under PUD standards applied to the alternative zoning map.

Alternative scenario 2A and **alternative scenario 2B** reflect **alternative zoning standards** for the Village district and the Rural Residential district applied to the **current zoning district map** (See Map 1).

The build out analysis consists of 5 basic steps

1. Develop a Base Map
2. Identify Existing Development
3. Determine Density Rules
4. Identify Environmental Constraints.
5. Calculate Additional and Total Development Potential

Base Map
The base maps were developed to maintain consistency between multiple build out scenarios. The base maps were derived from the Town's parcel and zoning district GIS data. Parcel lines were edited in areas where a parcel is split by two zoning districts. Once the necessary parcel lines are split, each parcel was assigned a zoning district code. Map 1 and Map 2 are effectively the base maps.

Existing Development
Existing development was identified from CCRPC's Housing Point database and Commercial Industrial database. The amount of existing development within the Town is included in the results section of this report.

Density Rules
The density rules were determined from the land use and development regulations effective March 11, 2010. Interpretations of the land development code were made under the guidance of the Director of Planning and Zoning to meet the specifications of the build out wizard. Multiple iterations of the build out analysis were conducted to refine the density rules to best reflect the likely future development pattern in the Town.

The density rules indicate the number of buildings per unit area and are applied differently for commercial and residential uses. For residential zoning districts, density is determined from minimum lot size per area. For non-residential zoning districts, commercial floor area is calculated from prescribing the likely building size on each parcel. For mixed-use zoning districts, both a residential and non-residential density rule is applied. If both a residential and non-residential density are specified then the percent residential area and percent non-residential area must also be specified. The mixed use percentages were determined by the Director of Planning and Zoning's local knowledge of the Town. Zoning districts were designated mixed used based on permitted uses identified in the zoning regulations. The Commercial, Village Center, and Village districts were designated mixed-use.

Additional assumptions were made throughout the analysis to better reflect environmental constraints and the amount of commercial floor area expected. These assumptions are reflected in the efficiency factors. The efficiency factors reduce the development potential to account for topography, soils, rivers, streams, wetlands, and other site constraints. This is reflected in the first or the lower efficiency factor in the subsequent tables in all the zoning districts except for the Village Center, Commercial and Commercial Expanded districts. The efficiency factors in the Village Center and Commercial districts have a different purpose. The first factor (60%) in the Village Center district represents density losses mentioned above for residential uses only. The second factor (38%) for the Village Center district and the (41%) in Commercial district aims to reduce the additional commercial floor area amount to better reflect the expected number of employees[1]. Also, the Village district on the current zoning map used in the base scenarios and in the alternative 2A and 2B scenarios is modeled as solely residential. However, the expanded Village district in alternative scenarios 1A and 1B is modeled as mixed-use including both additional dwelling units and commercial floor area.

Table 1
Current Zoning: Standard Subdivision + Current Zoning Map
(Base Scenario 1A & Alt Scenario 1A)

	Mixed Use	Mixed Use Ratio(res,com)	Min Lot size (acres)	Building Floor Area (sq. ft.)	Efficiency Factors
AGR	0		10	0	70%, 90%
COM & COM E	1	25%, 75%	1.00	8,000	41%
FOR	0		10	0	70%, 90%
OS	0		0	0	n/a
RR	0		3	0	55%, 80%
VCTR	1	80%, 20%	.25	6,000	60%, 38%
VIL & VIL E	1	95%, 5%	1.00	6,000	40%
COM-WHPO	1	25% 75%	1.00	8,000	50%

Table 2
Current Zoning: PUD Standards + Alternative Zoning Map
(Base Scenario 1B & Alternative Scenario 1B)

	Mixed Use	Mixed Use Ratio(res,com)	Min Lot size (acres)	Building Floor Area **(sq. ft.)**	Efficiency Factors
AGR	0		7	0	70%, 90%
COM	1	25% 75%	.33	8,000	41%
FOR	0		7	0	70%, 90%
OS	0		0	0	n/a
RR	0		1	0	55%, 80%
VCTR	1	80%, 20%	.1	6,000	60%, 38%
VIL	1	95%, 5%	.33	6,000	40%
COM-WHPO	1	25% 75%	.33	8,000	50%

Table 3
Current Zoning Standard Subdivision + Alternatives for RR, VIL + Current Zoning Map
(Alternative Scenario 2A)

	Mixed Use	Mixed Use Ratio(res,com)	Min Lot size (acres)	Building Floor Area **(sq. ft.)**	Efficiency Factors
AGR	0		10	0.00	70%, 90%
COM & COM E	1	25% 75%	1.00	8,000	41%
FOR	0		10	0.00	70%, 90%
OS	0		0.00	0.00	n/a
RR	0		1	0.00	55%, 80%
VCTR	1	80%, 20%	.25	6,000	60%, 38%
VIL	1	95%, 5%	.5	6,000	40%
COM-WHPO	1	25% 75%	1.00	8,000	50%

Table 4
Current Zoning: PUD Standards + Alternatives for VIL,RR + Current Zoning Map
(Alternative Scenario 2B)

	Mixed Use	Mixed Use Ratio(res,com)	Min Lot size (acres)	Building Floor Area **(sq. ft.)**	Efficiency Factors
AGR	0		7	0.00	70%, 90%
COM	1	25% 75%	.33	8,000	41%
FOR	0		7	0.00	70%, 90%
OS	0		0.00	0.00	n/a
RR	0		1	0.00	55%, 80%
VCTR	1	80%, 20%	.1	6,000	60%, 38%
VIL	1	95%, 5%	.33	6,000	40%
COM-WHPO	1	25% 75%	.33	8,000	50%

Environmental Constraints
Environmental constrains were applied either as a full constraint or a partial constraint. A full environmental constraint prohibits development on the parcel in its entirety. The full environmental constraints in this analysis are the Open Space District, conserved property, schools, and cemeteries. The partial constraints were determined by the presence of wetlands and associated buffers, surface waters and associated buffers, and the River District. In areas where these occurred, the potential dwelling units were reduced by 25% through the application of efficiency factors. Map 3 shows the location of the where these constraints were applied.

Additional and Total Development Potential
Additional and total development potential for each parcel in the Town were calculated with the inputs described above. The formulas for estimating additional dwelling units and commercial floor are shown below.

Buildable area relates to the area of the parcel minus the full constraint. For parcels with a partial environmental constraint, the buildable area equals the entire parcel area. The partial constraint is accounted for through the reduction of dwelling units or floor area by using the efficiency factor. The use fraction represents the portion of the parcel that is in a particular use. For example, if a parcel is in a mixed-use district then only 75% of the parcel will be allocated for dwelling units. For all parcels, first the total development potential is calculated and then the existing development is subtracted from it to get the additional development potential.

- Total Dwelling Units = ((Buildable Area)*(Use Fraction) * (Efficiency Factor))/(Min Lot Size) * (Efficiency Factor)
- Additional Development Potential = Total Development - Total Development
- Total Non-Residential Floor Area= (Building Size) * Efficiency Factor

Results

Table 5
Residential Build out Results

Zoning District	Additional Res Dwelling Units						Existing Residential Dwelling Units				Total Res Dwelling Units						Total Share of Res Growth at Build-Out					
	1A	1B	Alt 1A	Alt 1B	Alt 2A	Alt 2B	Base Map	Share of Growth	Alt Map	Share of Growth	1A	1B	Alt 1A	Alt 1B	Alt 2A	Alt 2B	1A	1B	Alt 1A	Alt 1B	Alt 2A	Alt 2B
AGR	325	458	274	377	325	458	421	23%	292	16%	746	879	566	669	746	879	22%	14%	15%	8%	17%	9%
COM	31	32	31	31	31	32	19	1%	19	1%	50	51	50	50	50	51	1%	1%	1%	1%	1%	0%
COM E	-	-	19	45	-	-		0%	18	1%	-	-	37	63	-	-	0%	0%	1%	1%	0%	0%
FOR	162	237	158	232	162	237	44	2%	39	2%	206	281	197	271	206	281	6%	4%	5%	3%	5%	3%
RR	264	954	208	735	954	3,691	400	22%	299	16%	664	1,354	507	1,034	1,354	4,091	19%	21%	13%	13%	31%	40%
VCTR	554	1,997	554	2,056	555	555	526	28%	526	28%	1,080	2,523	1,080	2,582	1,081	1,081	32%	40%	28%	32%	25%	11%
VIL	221	766	221	767	475	3,404	446	24%	445	24%	667	1,212	666	1,212	921	3,850	20%	19%	17%	15%	21%	38%
VIL E	-	-	566	2,087	-	-		0%	218	12%	-	-	784	2,305	-	-	0%	0%	20%	28%	0%	0%
Total	1,557	4,444	2,031	6,330	2,502	8,377	1,856	100%	1,856	100%	3,413	6,300	3,887	8,186	4,358	10,233	100%	100%	100%	100%	100%	100%

Table 5
Non-Residential Build out Results

Zoning District	Additional Commercial Floor Area (sq. ft.)						Existing Com Floor Area (sq. ft.)			
	1A	1B	Alt 1A	Alt 1B	Alt 2A	Alt 2B	Base Map	Share of Growth	Alt Map	Share of Growth
AGR								0%		0%
COM	96,864	103,424	96,284	102,844	103,424	89,724	40,181	38%	40,181	38%
COM E			85,280	85,280				0%		0%
FOR								0%		0%
RR								-		0%
VCTR	625,168	621,424	621,424	621,424	621,424	622,888	66,935	62%	66,935	62%
VIL								0%		0%
VIL E			688,800	681,600				0%		0%
Total	722,032	724,848	1,491,788	1,491,148	724,848	712,612	107,116	1%	107,116	58%

Zoning District	Total Floor Area (sq. ft.)						Total Share of Non Res Growth at Build-Out					
	1A	1B	Alt 1A	Alt 1B	Alt 2A	Alt 2B	1A	1B	Alt 1A	Alt 1B	Alt 2A	Alt 2B
AGR	-	-	-	-	-	-	0%	0%	0%	0%	0%	0%
COM	137,045	143,605	136,465	143,025	143,605	129,905	17%	17%	9%	9%	17%	16%
COM E	0	0	85,280	85,280	0	0	0%	0%	5%	5%	0%	0%
FOR	0	0	-	-	0	0	0%	0%	0%	0%	0%	0%
RR	-	0	-	-	-	-	0%	0%	0%	0%	0%	0%
VCTR	692,103	688,359	688,359	688,359	688,359	689,823	83%	83%	43%	43%	83%	84%
VIL	0	0	-	-	0	0	0%	0%	0%	0%	0%	0%
VIL E	0%	0%	688,800	681,600	0%	0	0%	0%	43%	43%	0%	0%
Total	829,148	831,964	1,598,904	1,598,264	831,964	819,728	100%	100%	100%	100%	100%	100%

Common Impacts Analysis

The common impacts analysis examines the implications of additional dwelling units and commercial floor area on energy use, population, water use, auto emissions, and the economy. The two major inputs to the common impacts analysis are the build out data and common assumptions detail in Table 6. CCRPC staff used local assumptions when available and appropriate. The assumptions are consistent across all 6 build out scenarios. However the impacts vary for each scenario because the dwelling unit and commercial floor areas are different for each scenario.

Table 6
Common Impacts Analysis Assumptions

Assumptions	Source	Value
Average Vehicle Trip Length (miles)	default verified	9.76
Annual Commercial Energy Use (mmbtu)	CCRPC ECOS Energy DRAFT #1 Table 4	88
Floor Area per Employee (sq. ft.)	CCRPC	500
Annual Household Energy Use (mmbtu)	CCRPC ECOS Energy DRAFT #1 Table 4	88
Daily Household Water Use (gallons/day)	VT Water Supply Rules -Average Daily Flows Engineering Design Criteria, 150 g/d per bedroom	450
Household Vehicle Trips per Day	default verified	6.2
Passenger Car Fuel Efficiency (mpg)	The average fuel economy for the U.S. car fleet (all cars on the road today) is 22.5 mpg. Center for Transportation Analysis-Energy Data Book	22.5
Percent Employed	2005-2009 ACS Data, 3,930 Employed/5,114 Total Population	76.8
Percent School Children	2010 Census % of people under 18	26.2
Persons per Household	2010 Census, Average Household Size of Owner Occupied, Renter is 2.19	2.72
Auto Emissions – CO (grams/gallon)	default verified	449.46
Auto Emissions - CO2 (lbs/gallon)	default verified	19.7
Auto Emissions-Hydrocarbons (grams/gallon)	default verified	60.16
Auto Emissions-NOx (grams/gallon)	default verified	29.82

The build out data combined with the assumptions and the impact formulas provide an indicator for looking at the growth consequences on population, school children, labor force, vehicle trips per day, annual auto emissions, residential and commercial energy use, and jobs. These indicators provide an overall measurement related to the various components of the municipality and apply to an entire scenario. The following charts show how the indicators vary by scenario. Each scenario represents the impact of existing development plus the impact from additional growth related to a particular scenario. For example, impacts for Base Scenario 1A is a combination of the impacts from existing development and additional development estimated from the build out analysis.

Figure 1: Dwelling Units

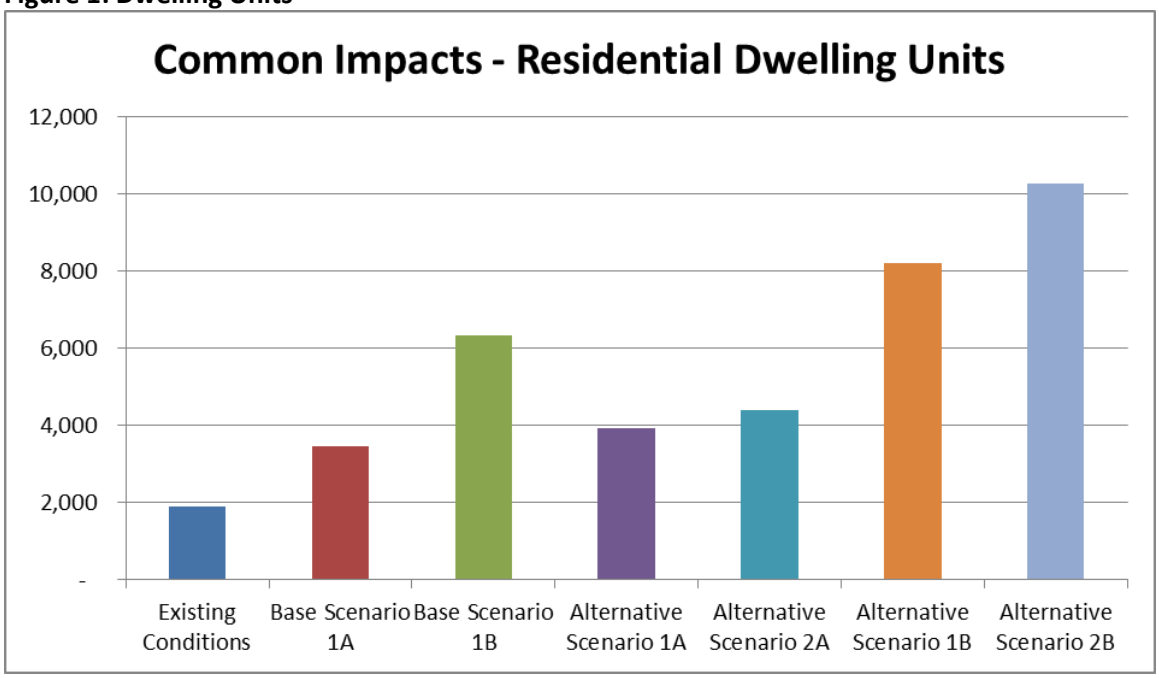
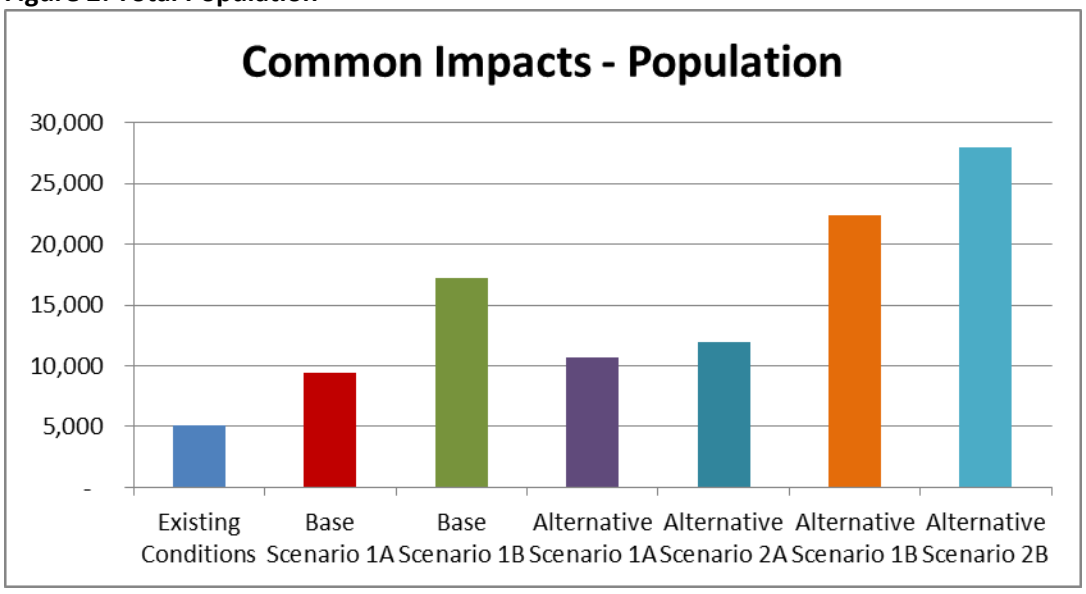


Figure 1 is directly related to the results of the build out analysis and shows the total residential development potential. The total residential development potential is the number of existing dwelling units plus the additional dwelling units estimated for each scenario.

Figure 2: Total Population



Total population for each scenario is determined by the average household size of 2.72 people times the number of dwelling units estimated from the build out analysis plus the existing population. Alternative Scenario 2B has the greatest impact on total population with an estimated population of 33,453 people. This scenario generated the most people because it

assumes smaller minimum lot sizes thereby increasing the density and ultimately the number of additional dwelling units. In contrast, Base Scenario 1A has the least effect on total population at 9,378 total people.

Figure 3: School Children

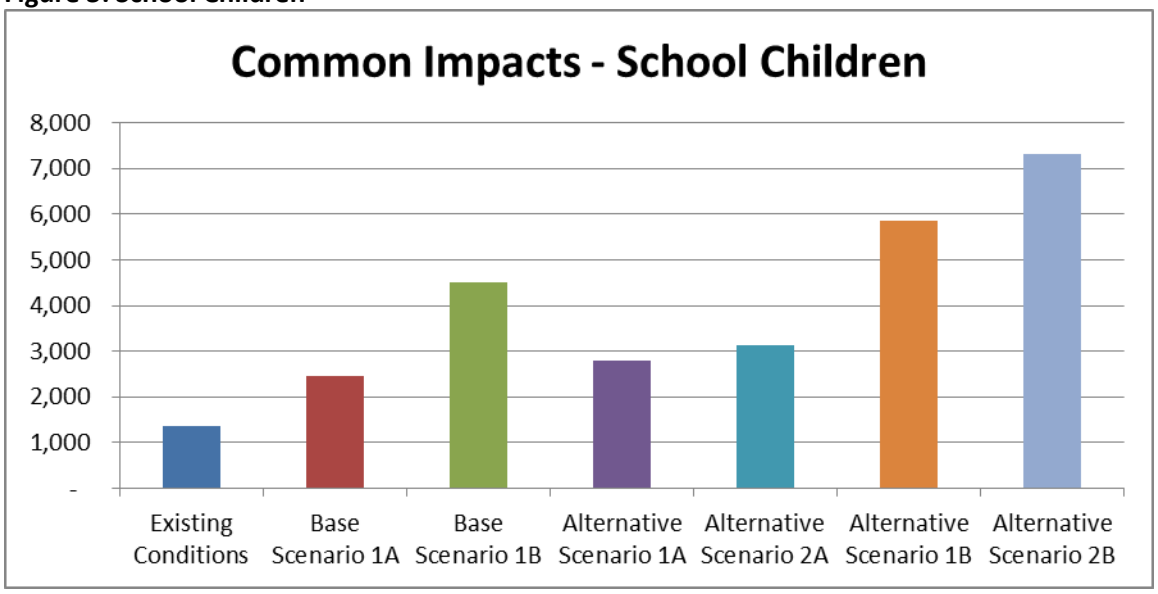
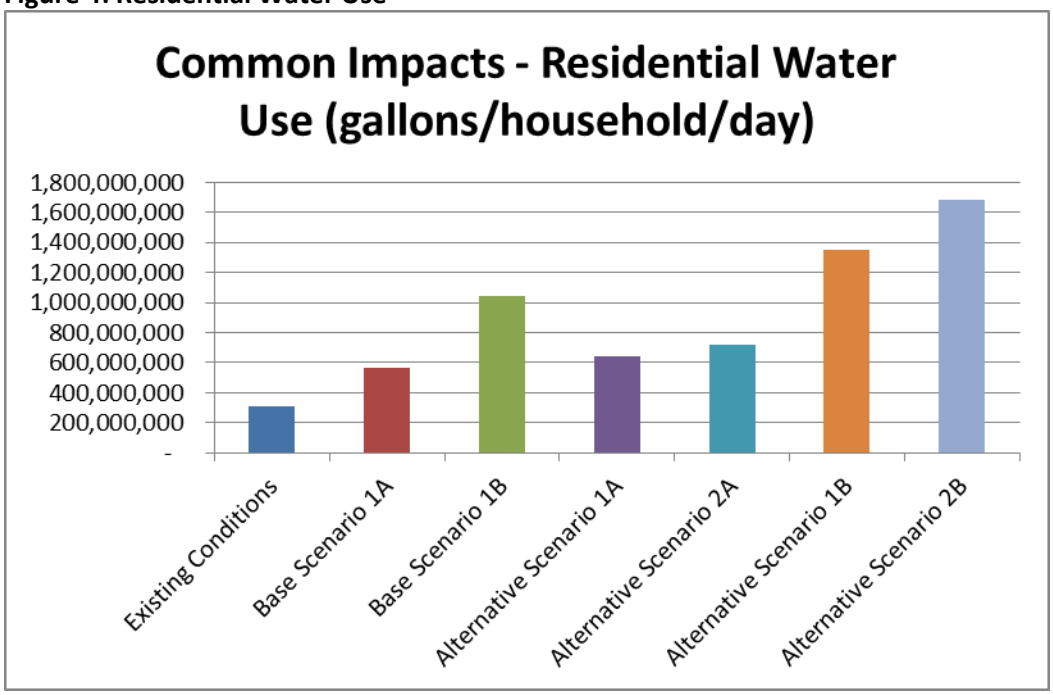


Figure 3 puts the zoning modification of each scenario in terms of the number of school children expected to help stakeholders understand the potential future impacts land use decisions have the school system. The United States Census of 2010 reports that 26.2% of the population in Jericho is under the age of 18. This assumption is consistent for all scenarios. The number of school children is based on the total population that is show in Figure 2. As a result, Alternative Scenario 2B yields the greatest amount of school children.

Figure 4: Residential Water Use



Increased development will increase the demand for household water use. Figure 4 provides an estimate of the potential water demand for the entire Town. Residents obtain their water from a variety of sources such as the Champlain Water District, the Jericho Underhill Water District, and private wells. As the Town's water needs change in the future, source protection and infrastructure planning are key considerations to ensure adequate water supply for residents. The assumptions for this impact are based on the Vermont Water Supply Rules and assume 450 gallons per day per household.

Figure 5: Residential Energy Use

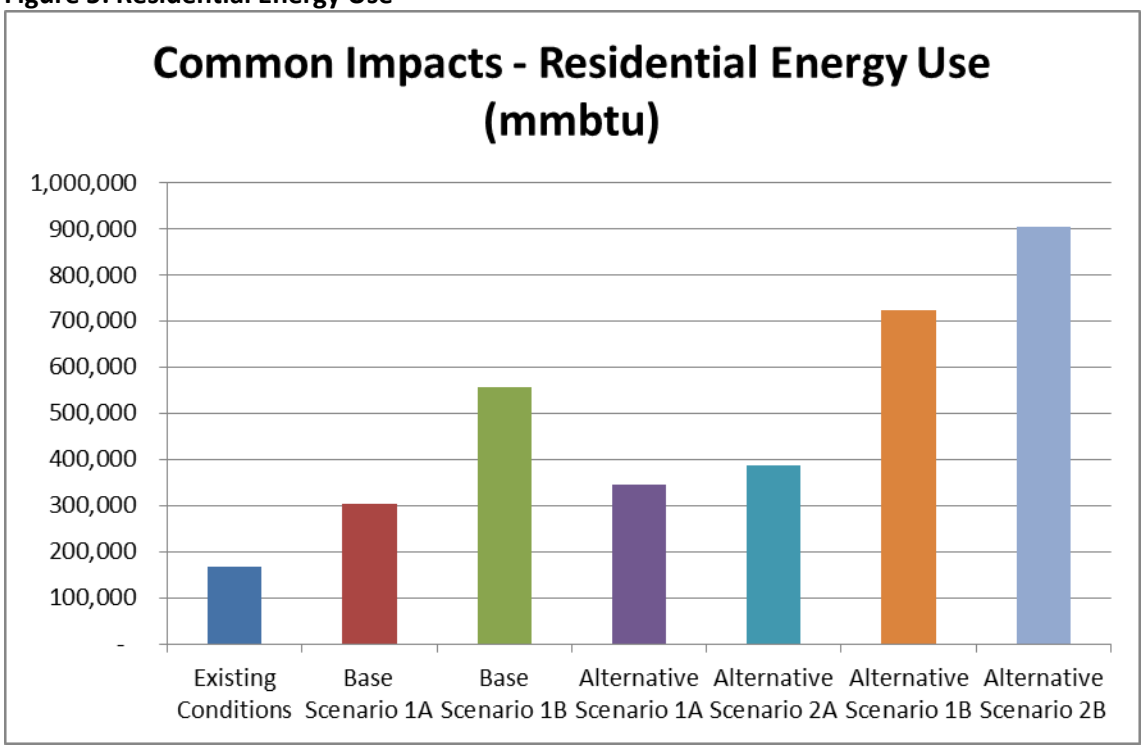
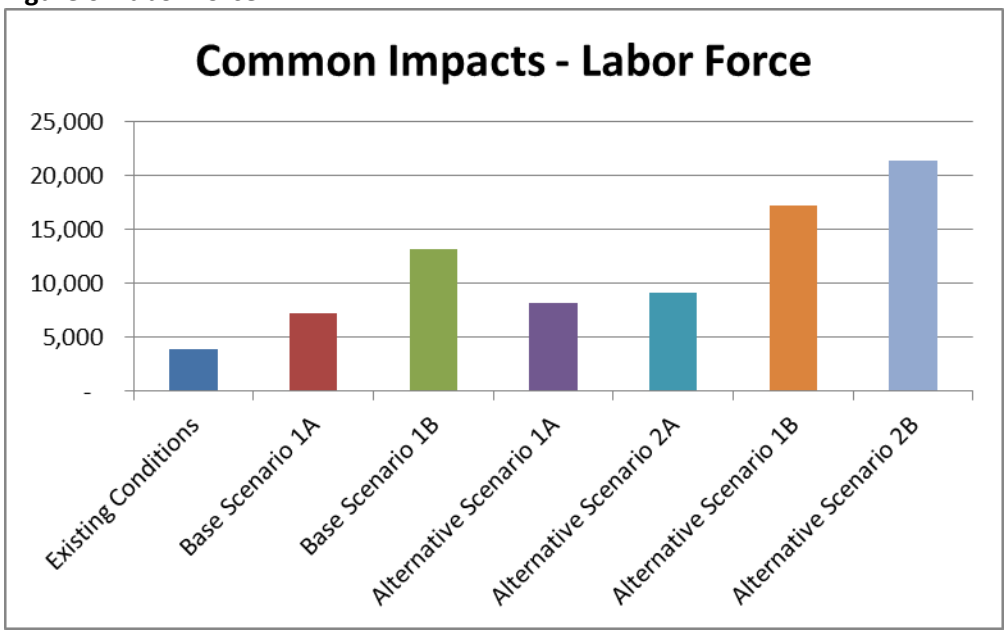


Figure 5 depicts total annual residential energy use for all applications, including electricity and heating. Residential energy use is estimated to be 88 mmbtu per household.

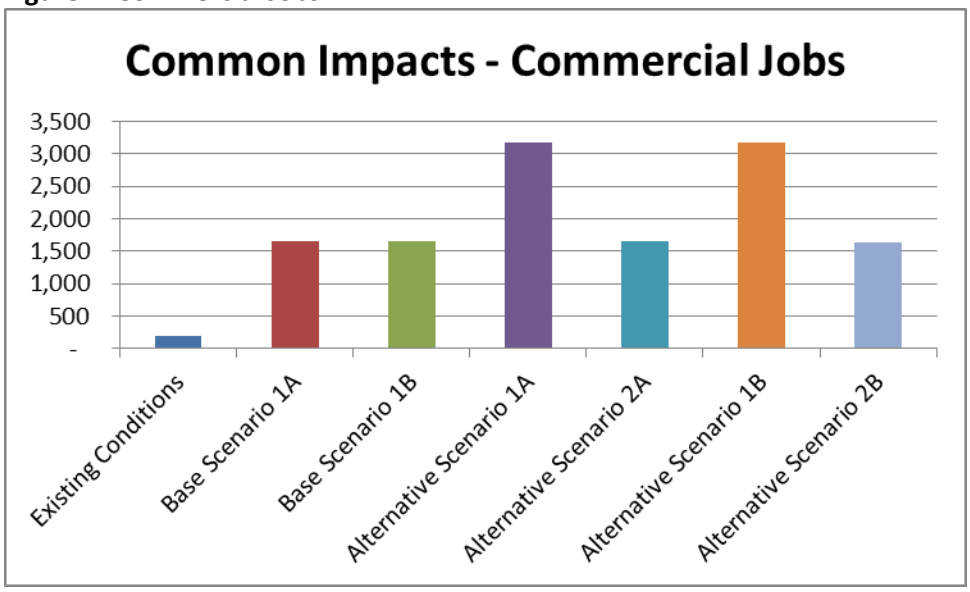
Figure 6: Labor Force



According to the American Community Survey, 75% of the population in Jericho is employed. Because population is directly related to housing units Alternative Scenario 2B yields the highest number of employees. The labor force indicator is intended to provide an estimate of the

number of job holders living in dwelling units in the Town. It does not account for the location of the jobs.

Figure 7: Commercial Jobs



The number of jobs in Figure 7 is determined from commercial floor area which is show in Figure 8 (below) divided by 500 sq. ft. per employee. Both Figure 7 and Figure 8 indicator relate to the commercial floor area calculated in the build out and are representative of the employment that the Town of Jericho can support, whereas the labor force indicator in Figure 6 reflects the number of employed people who live in Jericho and their workplace is unknown or not applicable in this analysis.

Figure 8: Commercial Floor Area

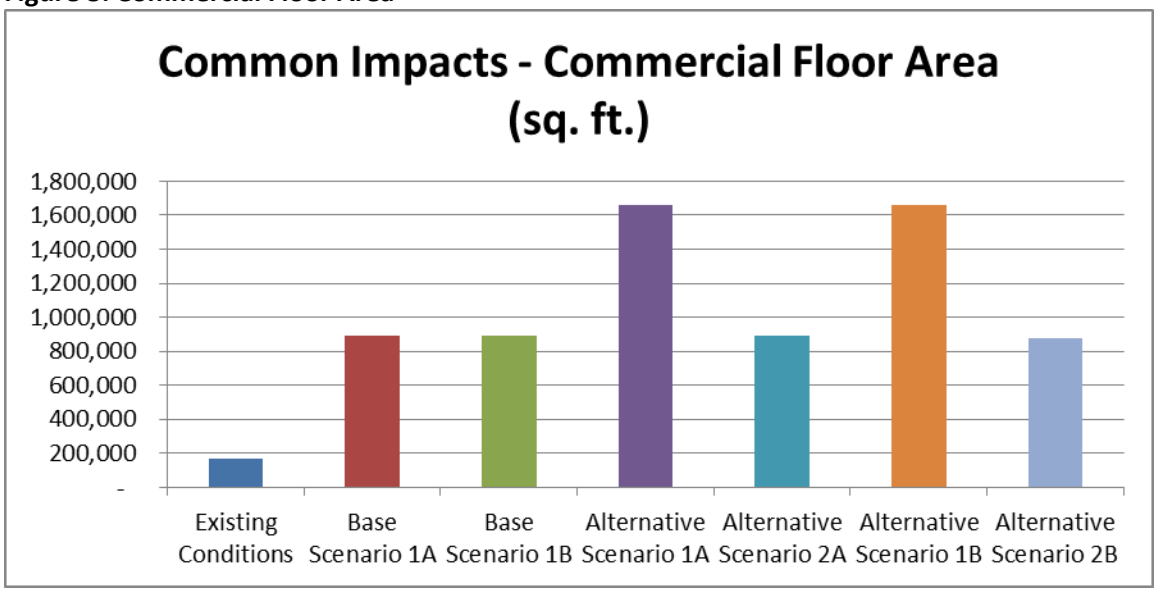


Figure 9: Commercial Energy Use

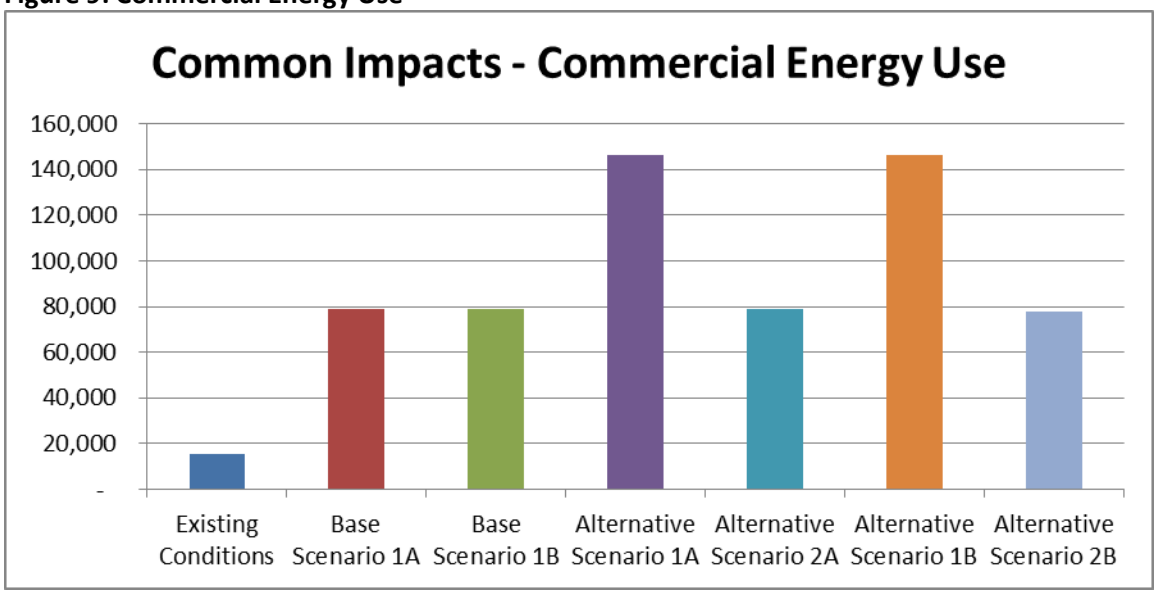


Figure 9 shows the commercial energy use for each scenario. The annual commercial energy use was assumed to be 88 mmbtu.

Figure 10: Vehicle Trips per Day

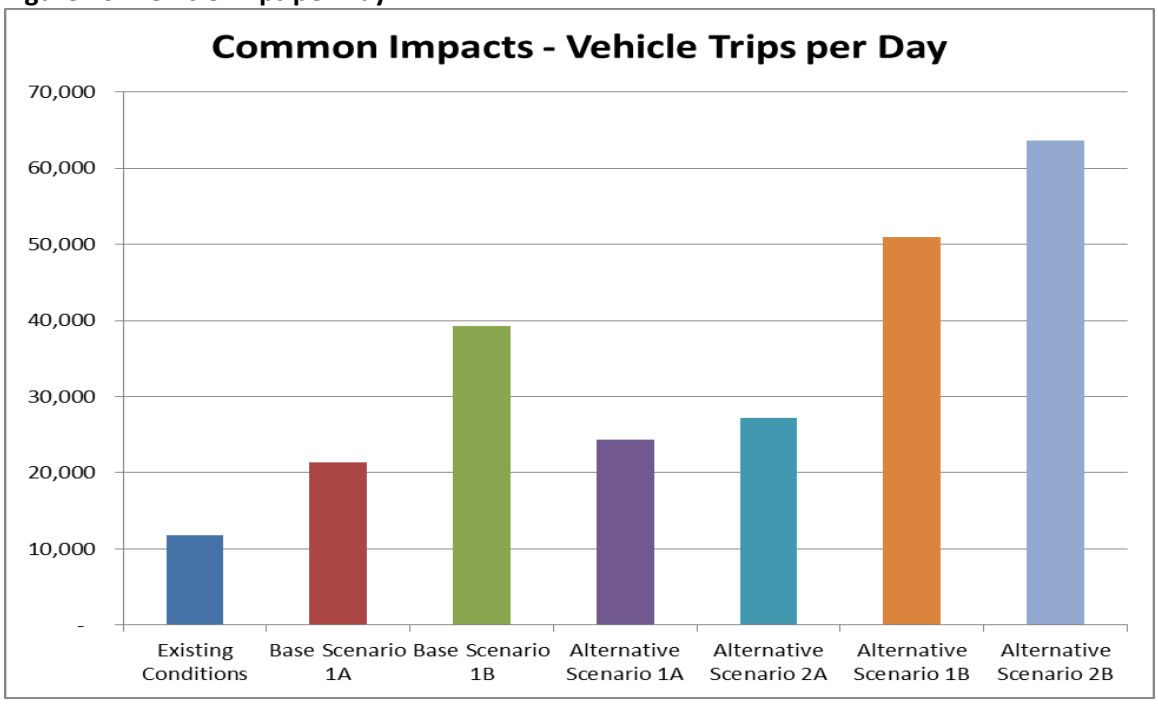


Figure 10 shows the vehicle trips per day. The average number of vehicle trips per household per day is 6.2. Vehicle trips per day originate from households, so the travel impact is directly related to the number of dwelling units. Alternative scenario 2B demonstrates this with the most number of dwelling units and highest number of vehicle trips per day.

Figure 11: Annual Auto CO Emissions

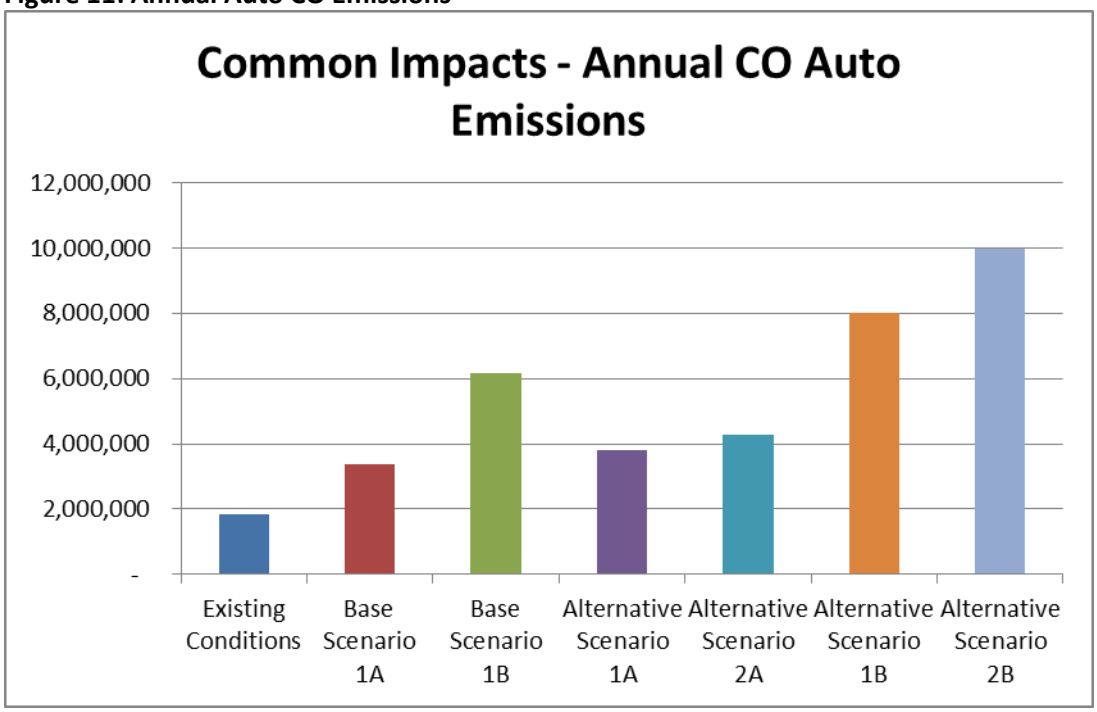


Figure 11 shows the impact of growth on total carbon monoxide (CO) emissions generated by vehicles. The CO emissions for passenger vehicles are estimated to be 449 grams/gallon of gas for all scenarios. The vehicles are associated with residential buildings, so an increase in dwelling units causes an increase in emissions. This impact also takes into consideration passenger car fuel efficiency and average vehicle trip length. The passenger car fuel efficiency is 22.5 mpg and the average vehicle trip length is 9.76 miles.

Figure 12: Annual CO2 Auto Emissions

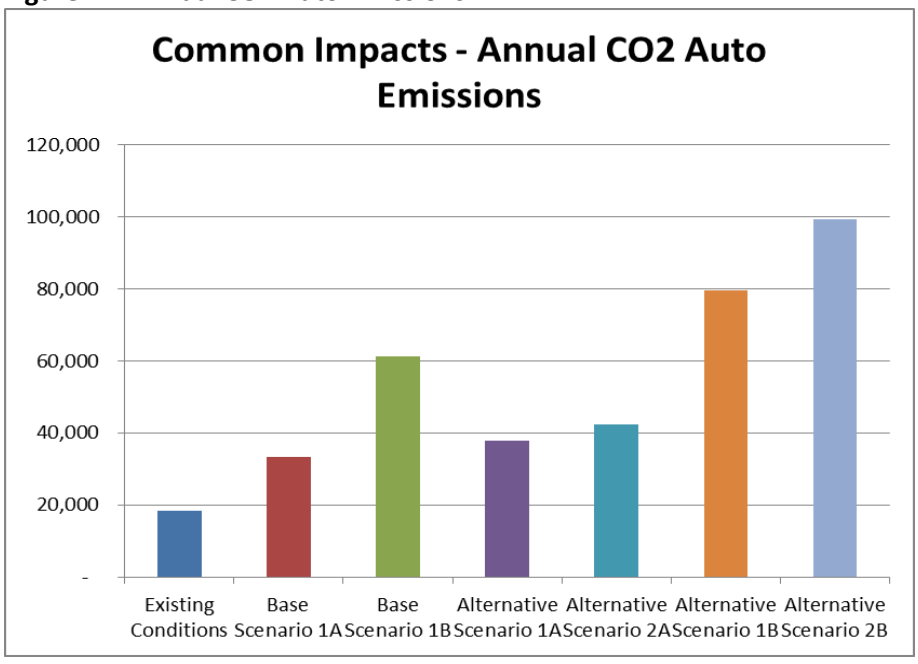


Figure 12 shows the impact of growth on total carbon dioxide (CO2) emissions generated by vehicles. The CO2 emissions for passenger vehicles are estimated to be 19.4 lbs/gallon of gas for all scenarios. The vehicles are associated with residential buildings, so an increase dwelling units causes an increase in emissions. This impact also takes into consideration passenger car fuel efficiency and average vehicle trip length. The passenger car fuel efficiency is 22.5 mpg and the average vehicle trip length is 9.76 miles.

Figure 13: Annual Hydrocarbon Auto Emissions

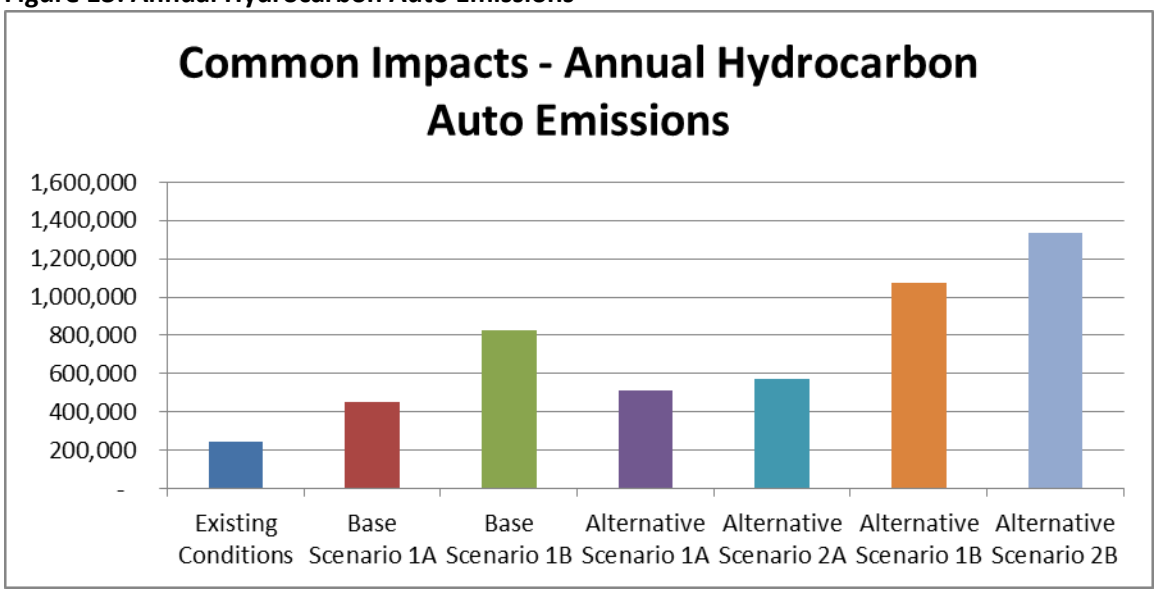
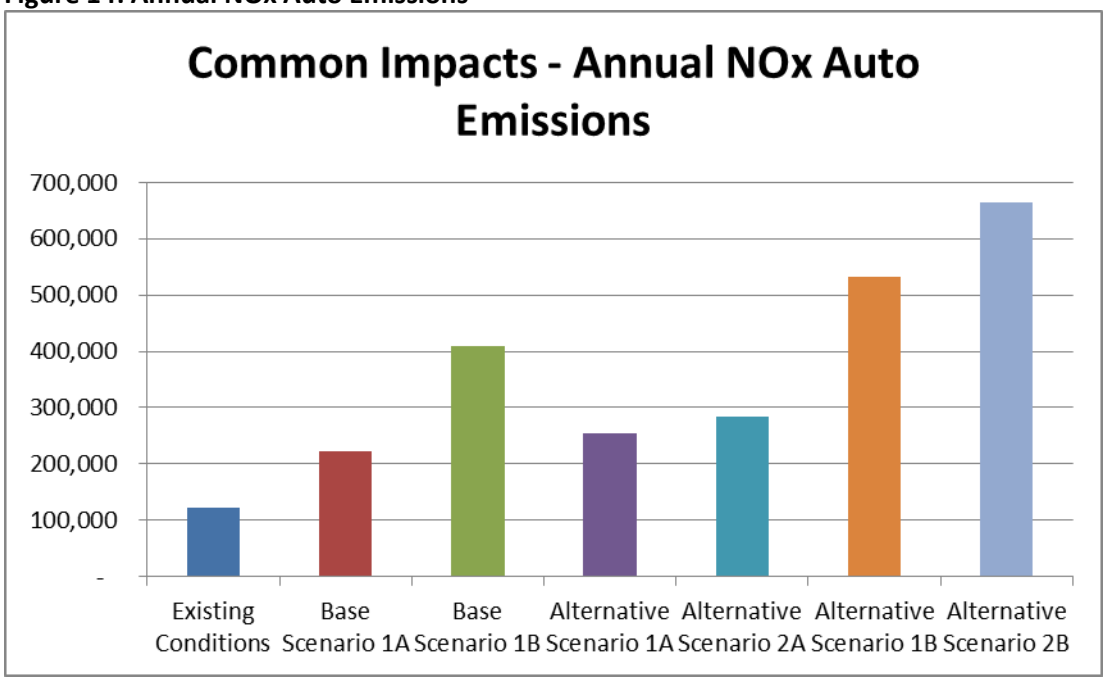


Figure 13 shows the impact of growth on total hydrocarbon auto emissions generated by vehicles. The hydrocarbon emissions for passenger vehicles are estimated to be 60.21 grams/gallon of gas for all scenarios. The vehicles are associated with residential buildings, so an increase more dwelling units yields increased emissions. This impact also takes into consideration passenger car fuel efficiency and average vehicle trip length. The passenger car fuel efficiency is 22.5 mpg and the average vehicle trip length is 9.76 miles.

Figure 14: Annual NOx Auto Emissions



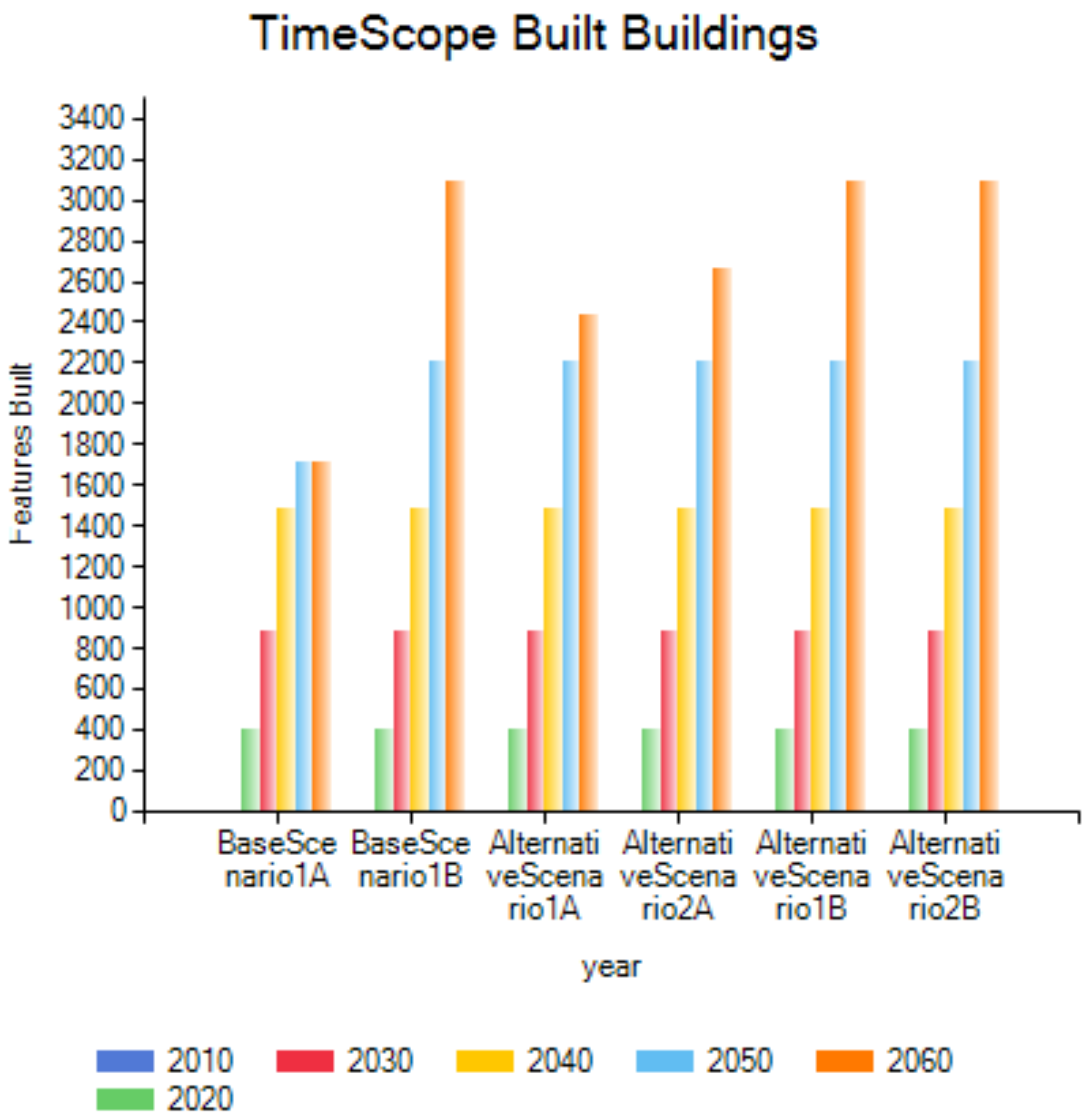
The annual nitrogen oxide (NOx) emissions from autos are estimated to be 29.89 grams/gallon.

Figures 11-14 all show the emissions related to number of dwelling units, distance of travel, and fuel efficiency. These indicators should be used with caution because they do not take into account the development pattern and potential mixes of land uses that are possible with the alternative scenarios. For example, Alternative Scenario 2B has the most emissions associated with it because it has the most residential development. This development could happen in a form that is at a higher density which supports walkable neighborhoods that are near services and jobs,. thereby reducing vehicle miles traveled and number of trips. Subsequent analyses that vary trip length and fuel efficiency would be necessary to model the impact these assumptions would have on emissions. The resulting vehicle emissions could also be mitigated by potentially increasing transit and park & ride options for residents commuting to their jobs outside of Jericho.

Timescope Analysis

The timescope analysis looks at growth over time. This analysis shows when buildings will be built over a certain period of time. The rate at which growth will happen is specified to be 2% for both residential and commercial buildings. The order in which the development happens is expected to be random. In other words, the analysis tool assigns the location of the buildings. It is important to be aware that the buildings relate to structures and do not represent the dwelling units. Also, this analysis is not a predictive model to tell you the likelihood that development will happen. Figure 15 (below) shows the amount of growth expected for every 10 years to 2060 for each scenario based on the growth rate of 2%.

Figure 15: Timescope Analysis



Conclusions

The build out and common impact analysis for the Town of Jericho provides decision makers a tool to understand both the quantity of new growth and development under existing and alternative land uses as well as the potential impacts growth could have on the community. The results from this analysis are good starting points for discussion that relate to the activities of the Planning Commission, the Energy Task Force, and other town boards and commissions. In essence, this project provides the avenue through which the Town of Jericho can assess the impacts of changes in land use policies and determine how those changes might match the goals articulated in the Town Plan.